Experiment classification: CNJ 01/2023

Primary objective: light (photon) spectral analysis

Secondary objective (optional): measuring the speed of the light C

Introduction:

I decided to conduct my first official CNJ scientific experiment - I will use high energy lasers to rip the spacetime fabric apart. I am kidding of course. My laser is not nearly powerful enough to do it. It has just 5 mW (five milliwatts), 0.005 W, compared to the 1.0E+15 W (1 petawatt or 1 PW), and much more, of power that high energy lasers possess.

I have chosen the lowest price handheld laser pointer from the Edmund Optics catalogue costing only 30 Euros.

My amateur laser is adequate to be used for practical everyday demonstrations like firing it through an optical prism to separate different

wavelenghts of the photon in order to make spectral analysis of the light beam. I am wondering what will happen since this pointer works at 650 nm wavelenght (6500 Angstrom). Will the optical prism split the beam into an entire light spectrum producing the desired rainbow effect? No, I expect it will refract and spread only the red component because it only consists of the red component.

I will also try to measure the speed of the light by using the special set of mirrors and precise clock. I am sure I will fail, I am certain without any doubt, but that will be an evidence how fast light is. Think: we already know that speed of the light is approx. three hundred thousand (300.000) km per sec. My laser pointer has 0.4572 km range. I am 99.99% short to perform this particular experiment within just a second of time. How can I measure with such disadvantage? I need much more sophisticated equipment. Hence, an impossibility to achieve it, with amateur tools at my disposal, actually proves the incredible velocity light possess.

People use strong lasers and atomic clock, on Earth, while retroreflector is placed on the Moon`s surface. This technique is called "Lunar Laser Ranging" and it is just one out of several which we have today at our disposal. No wonder why Galileo failed. He got to the same conclusion as I did: in order to measure C one must be properly equipped.

Thought experiment: you are standing on the equator. Earth`s circumference is about 40.000 km. Speed of the light is almost 300.000 km/s. If you fire a laser beam it would travel along the equator more than 7 times in a single

second. In a blink of an eye Light passes almost entire lenght of the equator. Roughly, if you fire a laser beam and blink with your eye(s) after you raise your lids you would see that beam coming from an opposite direction.

What is Light?

It is the visible part of the electromagnetic spectrum. Light consists of six (6) different, yet complementary, colours (red, orange, yellow, green, blue, violet) each having its own distinct wavelenght and frequency which are inversely proportional.

Current definition of the second (1 sec) is established using a Cesium atomic clock, although Ytterbium is fighting its way to replace Cesium, as time needed for exactly 9,192,631,770 oscillations to complete their one full round. With this specification we can also define both the speed of the light, C, as 299,792,458 meters per SECOND and lenght basic unit - meter as the path travelled by the light in a vacuum during a time period of right accurately 1 / 299 792 458 second...

Recording a light

Scientists recorded the speed of the light, C, with an ultrafast camera (10 trillion frames per second) developed by professor Lihong Wang from Caltech Division of Engineering and Applied Science:

https://www.youtube.com/watch?v=7Ys_yKGNFRQ

https://www.youtube.com/watch?v=pvDJ_d1n5ml

It is really amazing to see light in the slow motion. Also, now you have the picture what kind of equipment you need to measure a velocity of a photon beam. Notice that they use blue spectrum laser in their experiment.

Colours

Fundamental colours and their corresponding wavelenght (frequency):

Violet: 380–450 nm (789-666 THz)

Blue: 450–495 nm (665-606 THz)

Green: 495–570 nm (605-526 THz)

Yellow: 570–590 nm (525-508 THz)

Orange: 590–620 nm(507-484 THz)

Red: 620–750 nm (483-400 THz)

Black is not a color. It is an absence of a color.

Frequency is inversely proportional to the wavelenght: the lower the wavelenght the higher the frequency and vice versa. Among visible light spectrum (ultra)violet light has the lowest wavelenght and highest frequency. That is why we use UV protection during a hot summer days.

$C = f \times \lambda$

$\lambda = C / f$

$f = C / \lambda$

c = speed of the light (m/s)

f = frequency (Hz)

λ (lambda) = wavelenght (m)

I noticed very interesting correspondence: energy (photon) is comprised of the six (6) wavelenghts and hadrons are comprised of the six (6) quarks (baryons - odd number of quarks, usually three; and mesons - even number of quarks, usually two). Meaning, energy and matter is interchangeable. It is the same thing but in a different form. Energy can materialize, matter can energize. With further implications I leave aside for the time being.

When all the visible colors are summed together it is called the "white light". Matter analogy would be when we sum, theoretically, all six (6) quarks together. Then we would get the "white substance".

Equipment used:

Laser: 5 mW strenght, 650 nm wavelenght (red part of the light spectrum), 3.175 mm beam diameter, handheld.

Optical prism: triangular.

05/05/2023

Laser pointer and optical prism have arrived.

26/7/2023

It took few months before I started this experiment. I was working on other things as well. Finally, here it is.

The setting looks like this: flat surface surrounded by white papers to clearly exhibit the red dot, amateur smartphone video recording, light green transparent liquid, a white smoke.

https://primary.jwwb.nl/public/z/h/o/temp-fjndzoiqqbsgaxnmaduw/3h02up/cnjexpsetting01.jpg?enable-io=true&enable=upscale&width=448

First I will fire a laser beam through an optical prism. Then I will fire a laser beam through a special liquid. Last comes firing through the white smoke.

Actually, there is no laser beam just the red dot. The reason is very low

power only 5 mW. In some youtube videos I have seen red lasers with 80 mW strenght that produced a beam and even burned a match. I guess it is a sufficient amount of photons per unit of volume which makes the beam visible and strong.

I`m pretty excited.

Let me start. I am turning on the recording...

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My experiment was a success. I have seen very interesting dance of light when it was directed through an optical prism and a real laser beam when

light was released through an adequate medium.

There must be a significant loss included due to the dispersion and dissipation of light through an optical prism.